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THE MIOCENE MOLLUSCA OF THE STATE OF NEW JERSEY.

BY PROF. ANGELO HEILPRIN.

The known forms of miocene mollusca of the State of New Jersey numbered up to 1884, the year when I published my "Contributions to the Tertiary Geology and Paleontology of the United States," some thirty species, as follows:

Ostrea Virginica (*O. Mauricensis*.)*Ostrea percrassa**Pecten Humphreysii**Plicatula densata**Mytilus inflatus*?*Lithodomus subalveatus**Carditamera aculeata**Carditamera arata**Crassatella melina**Astarte Thomasii**Astarte distans**Mysia parilis**Yoldia limatula**Venus Ducatellii**Venus plena**Mercenaria cancellata**Tellina Shilohensis**Tellina peracuta**Tellinella*(?)*capillifera**Thracia myæformis**Anatina alta**Corbula elevata**Saxicava parilis**Turbinella Woodi**Fulgur scalariformis**Natica catenoides*?*Turritella æquistriata**Turritella Cumberlandia**Turritella secta**Fissurella Griscomi*.

Several excursions with my class to the "marl" diggings near Shiloh, Cumberland Co., and the examination of material from an artesian well-boring in Atlantic City (kindly placed in my hands by Mr. Lewis Woolman), enable me to increase this list by about fifty species, of which some four or five prove to be new forms. The following species have been identified from the diggings near Shiloh :

Ostrea percrassa

Pecten Humphreysii, var. *Woolmani* (Heilprin)

Pecten Madisonius

Plicatula densata

Mytilus inflatus

Mytiloconcha incurva

Lithodomus sp.?

Perna maxillata

Arca centenaria

Arca Marylandica

Pectunculus lentiformis

Nucula obliqua

Yoldia limatula

Astarte distans

Astarte compsonema

Crassatella melina

Carditamera arata

Carditamera aculeata

Lucina crenulata

Cardium laqueatum

Chama congregata

Venus athleta

Venus mercenaria?

Venus (*Mercenaria cancellata*? Gabb.)

Mactra lateralis

Tellina sp.?

Teredo sp.?

Saxicava parilis? (*S. insita*?)

Murex nov. sp.

Turbinella Woodi

Fulgur scalariformis

Cantharus Cumberlandianus

Nassa trivittata

Columbella communis

Terebra curvilirata
Triforis nov. sp.
Cancellaria sp.?
Marginella sp.?
Pleurotoma nov. sp.
Turbo eboreus
Carinorbis (*Delphinula*) *globulus*
(*D. lyra*? Conrad)
Natica hemicrypta
Turritella Cumberlandia
Turritella aequistriata
Trochita centralis
Crucibulum costatum
Crepidula fornicata
Crepidula plana?
Fissurella Griscomi
Discina (*Orbicula*) *lugubris*

Of the species here indicated the greater number have been found in States other than New Jersey, and leave no doubt that the deposits which they represent constitute a part of the regular Miocene series of the Atlantic border. The general faunal facies is most nearly that of the Lower Atlantic Miocene ("Marylandian") or Middle Atlantic Miocene ("Virginian"), with a decided leaning toward the former, whose position it occupies geographically. I have elsewhere (Proc. Acad. Nat. Sci. Phila., 1880 pp. 31-32; Contrib. Tert. Geol. and Paleont. U. S., p. 9,) given reasons for referring these Cumberland County deposits to the "Marylandian" division of the Atlantic Miocene, a reference which appears justified, apart from other considerations, by the presence of such fossils as *Ostrea percrassa*, *Pecten Humphreysii*, *Perna maxillata*, *Crassatella melina*, etc. These species belong to the Lower Miocene (Contrib. Tert. Geol. and Paleont. U. S., pp. 71 and 77), and characterize principally the basal series of deposits. Indeed, it is a little questionable if they do not actually connect with the Oligocene.

The newer Miocene deposits, as determined by their fossil remains, had not been recognized in the State prior to the present year, although the existence of such deposits in their proper position could not reasonably be doubted. In my work above referred to (1884) I remark (p. 9): "It is very likely that both divisions of the Miocene indicated by me as occurring in Maryland and Virginia,

and by me designated as the 'Marylandian' and 'Virginian,' or the lower and middle Atlantic Miocenes respectively, will eventually be found to be equally well-marked off in New Jersey, although up to the present time, from the sparseness of the fossil remains that have been collected, no such subdivision could be satisfactorily attempted. But from what material we have at hand, it may be safely asserted that the localities which have been so assiduously searched in the neighborhood of Shiloh, and elsewhere in Salem and Cumberland Counties, belong to the older, or 'Marylandian' division."

The existence of the newer Miocene deposits has now been definitely determined through the material obtained by Mr. Woolman from the artesian boring at Atlantic City, which has been placed in my hands for examination. The species of fossils obtained here are the following:

Discina lugubris
Ostrea sp.?
Anomia ephippium ?
Pecten Madisonius
Pecten Humphreysii
Pecten vicenarius ?
Perna maxillata
Mytilus incrassatus
Mytiloconcha incurva
Arca centenaria
Arca subrostrata
Arca idonea ?
Arca lienosa ?
Nucula obliqua
Astarte compsonema
Astarte obruta
Astarte perplana ?
Astarte Thomasii
Cardita granulata
Carditamera arata
Crassatella melina
Cardium (laqueatum ?)
Lucina trisulcata ?
Lucina crenulata
Mysia sp. ?

Cytherea Sayana ?
Artemis acetabulum
Venus sp. ?
Donax variabilis
Mastra lateralis
Mastra ponderosa ?
Tellina declivis
Tellina subreflexa
Corbula idonea
Corbula elevata
Turbinella Woodi
Fulgur sp ?
Nassa trivittata
Natica sp. ?
Turritella Cumberlania
Turritella æquistriata
Turritella plebeia
 Barnacles
 Echinoid fragments
Dendrophyllia (coral)
Lamna compressa
Odontaspis
Myliobatis
 Crocodilian bone

Many of the species occur only in fragments, but the greater number admit of definite determination. Unfortunately, in most instances, the depth at which they were obtained could not be ascertained, and in so far, therefore, such species give but little positive evidence as to the horizons which they actually represent. But the introduction of a very considerable number of forms, as compared with the number of such forms occurring in the deposits near Shiloh, which are more or less characteristic of the "Virginian" (Middle Atlantic Miocene) deposits, and those of still newer date ("Carolinian"), leave no room for doubt that a distinct faunal horizon,—the correspondent, in all probability, of the Middle Miocene—is penetrated by the bore. Again, that the older beds are also represented is proved by the occurrence of *Perna maxillata*, *Pecten Humphreysii*, *Crassatella melina*, etc., but only in the case of the first-named species, *Perna maxillata*, could the absolute position—depth of some 800 feet—in the section be obtained. The po-

sition here indicated accords approximately with the theoretical position deduced from a calculation of dip and strike, using the Shiloh Perna beds as an equivalent. At a height of some 350 feet above the Perna beds, and consequently, at an actual depth of about 450 feet, occurs a stratum containing large numbers of *Turritella plebeia*, a species, which in Maryland, incisively marks the newer Miocene deposits of the State (*i. e.* the "Virginian"), as distinguished from the older ("Marylandian"). Its presence in the position which it occupies in the Atlantic City bore section would, of itself, be almost sufficient to determine the existence of a second faunal horizon.

The following table enumerates, as far as is known to me, all the Molluscan species that have been thus far determined from the Miocene formation of the State:

- Discina lugubris*, Conr. Mioc. Foss., p. 75.
Ostrea Virginica (*O. Mauricensis*) Gmel.
Ostrea percrassa, Conr. Mioc. Foss., p. 50.
Pecten Humphreysii, Conr. Bull. Nat. Inst., p. 194.
Pecten Madisonius, Say. Journ. A. N. S., IV. p. 134.
Pecten vicenarius? Conr. Proc. A. N. S., 1. p. 306.
Anomia ephippium? L.
Plicatula densata, Conr. Proc. A. N. S. 1. p. 311.
Mytilus inflatus, Tuomey and Holmes. Plioc. Foss., p. 33.
Mytilus incrassatus, Conr. A. J. Science, XLI., p. 247.
Mytiloconcha incurva, Conr. Mioc. Foss., p. 52.
Lithodomus subalveatus, Conr. A. J. Conch., II, p. 73.
Perna maxillata, Lam.
Arca centenaria, Say. Journ. A. N. S., IV., p. 138.
Arca Marylandica, Conr. Mioc. Foss., p. 54.
Arca subrostrata, Conr. Mioc. Foss., p. 58.
Arca idonea? Conr. Foss. Tert. Form., p. 15.
Arca lienosa? Say. Amer. Conch., pl. 36.
Pectunculus lentiformis, Conr. Mioc. Foss., p. 64.
Nucula obliqua, Say. A. J. Science, II, p. 40.
Yoldia limatula, Say. Amer. Conch., pl. 12.
Astarte compsonema, Conr. A. J. Conch., II, p. 72.
Astarte obruta, Conr. Journ. A. N. S., VII, p. 15.
Astarte perplana? Conr. Mioc. Foss., p. 43.
Astarte Thomasii, Conr. Proc. A. N. S., VII, p. 267.
Astarte distans, Conr. Proc. A. N. S., 14, p. 288.
Crassatella melina, Conr. Mioc. Foss., p. 22.

- Cardita granulata*, Say. Journ. A. N. S., IV., p. 142.
Carditamera arata, Conr. Mioc. Foss., p. 11.
Carditamera aculeata, Conr. Proc. A. N. S., 14, p. 585.
Lucina crenulata, Conr. Mioc. Foss., p. 39.
Lucina trisulcata? Conr. A. J. Science, XLI, p. 346.
Mysia parilis, Conr. A. J. Conch., II, p. 71.
Mysia sp.?
Chama congregata, Conr. A. J. Science, XXIII, p. 341.
Cardium laqueatum, Conr. Mioc. Foss., p. 31.
Cytherea Sayana, Conr. Mioc. Foss., p. 13.
Venus Ducatellii, Conr. Mioc. Foss., p. 8.
Venus plena, Conr. A. J. Conch., V, p. 100.
Venus latilirata, Conr. Proc. A. N. S., 1, p. 28.
Venus sp.?
Mercenaria cancellata, Gabb. Journ. A. N. S., IV, p. 376.
Artemis acetabulum, Conr. Foss. Tert. Form., p. 20.
Mactra lateralis, Say. Journ. A. N. S., II, p. 309.
Mactra ponderosa? Conr. Journ. A. N. S., VI, p. 228.
Donax variabilis, Tuomey and Holmes. Plioc. Foss. p. 95.
Tellina Shilohensis
Tellina declivis, Say. Journ. A. N. S., VII, p. 131.
Tellina peracuta, Conr. A. J. Conch., II, p. 71.
Tellinella capillifera, Conr. A. J. Conch., II, p. 71.
Amphidesma subreflexa, Conr. Journ. A. N. S., VII, p. 133.
Thracia myæformis, Conr. Proc. A. N. S., 14, p. 585, as *Saxicava*.
Anatina alta, Conr. Proc. A. N. S. 14, p. 585.
Corbula elevata, Conr. Mioc. Foss., p. 7.
Corbula idonea, Conr. A. J. Sci., XXIII, p. 341.
Saxicava parilis, Conr. A. J. Conch., II, p. 70.
Saxicava incita?
Teredo sp.? Conr. A. J. Conch., v, p. 101.
Murex nov. sp.
Turbinella Woodi, Gabb. Journ. A. N. S. (2d ser.) IV, p. 375.
Cantharus Cumberlandianus, Gabb. Journ. A. N. S., 2d ser., IV, p. 375.
Fulgur scalarispira, Conr. Proc. A. N. S., 14, p. 584.
Nassa trivittata, Say. Journ. A. N. S., II, p. 231.
Columbella communis, Conr. Proc. A. N. S., 14, p. 287.
Terebra curvilirata, Conr. Proc. A. N. S., 1, p. 327.
Triforis nov. sp.

Cancellaria sp.?

Marginella sp.?

Pleurotoma nov. sp.

Natica hemicrypta, Gabb. Journ. A. N. S. (2d ser.), IV, p. 375.

Natica catenoides? Wood. Crag. Moll., p. 141.

Turbo eboreus, Wagner. Journ. A. N. S., VIII, p. 52,

Carinorbis (Delphinula) globulus, H. C. Lea. Trans. Am. Phil. Soc.,
(*D. lyra*? Conrad.) [IX, p. 262.]

Turritella æquistriata, Conr. Proc. A. N. S., 14, p. 584.

Turritella Cumberlandia, Conr. Proc. A. N. S., 14, p. 584.

Turritella secta, Conr. Proc. A. N. S., VII, p. 268.

Turritella plebeia, Say. Journ. A. N. S., IV, p. 125.

Trochita centralis, Conr. A. J. Science, XLI, p. 348.

Crucibulum costatum, Say. Journ. A. N. S., IV, p. 132.

Crepidula fornicata, Say. Journ. A. N. S., II, p. 225.

Crepidula plana? Say. Journ. A. N. S., II, p. 226.

Fissurella Griscomi, Conr. Mioc. Foss., p. 78.

The references to descriptions do not necessarily indicate first description.

Notes on New and Old Species.

Murex Shilohensis. nov. sp.

Whorls about seven, angular, flattened on the shoulder, which is crossed diagonally by the variceal ridges; varices about eight on the body-whorl, sub-equal, spinosely elevated on the shoulder angulation, and crossed by four sub-equal revolving ridges, which appear double on the crests of the varices; only two such ridges on the whorls above the body-whorl.

Aperture somewhat more than half the length of shell, key-hole shaped, with the canal broadly deflected. Length nearly .75 inch.

A single specimen from Ayres' pits, near Shiloh, in the possession of Miss Emma Walter, of Philadelphia.

Pleurotoma pseudeburnea. nov. sp.

Spire elevated, of about ten volutions; apex papillate; whorls convex, porcellanous, strongly ribbed, somewhat impressed on the shoulder; ribs numerous, deflected, those of the several whorls alternating in position. No revolving lines.

Aperture about one-third the length of shell; canal slightly deflected; columellar lip well defined.

Length, slightly exceeding a half-inch.

From Ayres' pits near Shiloh. Fairly abundant. From the collection of Miss Mary S. Holmes, of Philadelphia.

Triforis terebrata. nov. sp.

Spire gradually tapering, nearly parallel-sided; whorls? flat, ornamented (on the body-whorl) with two prominently beaded lines, and two alternating lines of smaller beads; on the whorls above the body-whorl the lowest line is indistinct, or entirely covered over; transverse lines connect the beads of the different series; columella smooth, arcuate.

Length, ?

A fragment only, showing three whorls, from Ayres' pits, near Shiloh; in the possession of Miss Ella Lyndall, of Philadelphia.

The species appears to be most closely related to *Cerithium* (*Triforis*) *moniliferum*, of H. C. Lea.

Pecten Humphreysii, var. **Woolmani**.

Under this name I propose to designate a *Pecten*, which appears to be only a variety or sub-species of the Maryland *P. Humphreysii*, differing from the normal type of that species in the greater elevation of the ears, and the more distinct quadrangulation of the ribs of the convex valve. The ribs are also more prominently lined. All the New Jersey specimens that I have seen of what appears to be *Pecten Humphreysii* agree in these characters.

Illustrations of these species will be given in a future paper.

Note. Since the preparation of the above Mr. Woolman has obtained from the Atlantic City boring *Nassa obsoleta*, the impression of a fish-scale, and several Foraminifera (*Cristellaria*, *Robulina*, etc.)